

## CLAIMS

### **We claim:**

- 5     1.     A semiconductor integrated circuit (IC) package comprising:  
          a substrate including at least one electrical ground plane and having a plurality solder balls formed on a surface thereof, said solder balls including a set of thermal solder balls positioned near the perimeter of the package;  
          an integrated circuit die mounted to the substrate such that the die is  
10    electrically connected with some of the solder balls; and  
          a heat spreader mounted on the package such that the heat spreader is in thermal communication with the die and also in thermal communication with the set of thermal solder balls positioned near the perimeter of the package thereby enabling a portion of the heat generated by the die to be dissipated from the die  
15    through the heat spreader into the set of thermal solder balls.
  
2.     The IC package of Claim 1 wherein the set of thermal solder balls is electrically connected to said at least one electrical ground plane; and  
          wherein the heat spreader, at least one electrical ground plane, and the set  
20    of thermal solder balls are arranged so that heat generated by the die can be dissipated from the die through the heat spreader into the at least one electrical ground plane and into the set of thermal solder balls.
  
- 25    3.     The IC package of Claim 2 wherein the heat spreader electrically connected to the ground plane operates to reduce electrical noise generated by the package.
  
4.     The IC package of Claim 3 wherein the heat spreader is connected to the thermal solder balls using conductive mounting pegs and wherein the heat

spreader forms part of a electromagnetic shield that reduces the overall electrical noise generated by the package.

5. The IC package of Claim 3 wherein the heat spreader is connected to the thermal solder balls using conductive mounting pegs and wherein the heat spreader, mounting pegs, and thermal solder balls form, in combination, part of a electromagnetic shield that reduces the overall electrical noised generated by the package.
- 10 6. The IC package of Claim 1 wherein the package comprises a ball grid array package.
- 15 7. The IC package of Claim 1 wherein the package comprises a flip chip package.
8. The IC package of Claim 2 wherein the package comprises a ball grid array package.
9. The IC package of Claim 2 wherein the package comprises a flip chip package.
- 20 10. A system comprising:
  - a system board having a system ground;
  - an integrated circuit package including
    - 25 a substrate having at least one ground line and a plurality of solder balls formed on a surface thereof, the solder balls including a set of thermal solder balls formed near the edges of the substrate,
    - an integrated circuit die electrically connected to the ground line and to at least some of the solder balls,

5                   a heat spreader mounted in thermal communication with the integrated circuit die and electrically connected to the ground line and electrically connected to the thermal solder balls such that the ground line, and heat spreader operate to reduce electrical noise generated by the package; and

10                   the package mounted to the system board using the solder balls such that the package ground line is electrically connected with the system ground and such that at least some of the heat produced by the die is dissipated by the heat spreader through the ground line into the thermal solder balls and into the system board.

11.       The IC package of Claim 10 wherein the package comprises a ball grid array package.

12.       The IC package of Claim 10 wherein the package comprises a flip chip package.

13.       The IC package of Claim 10 wherein the ground line of the substrate comprises a ground plane.

20       14.       The IC package of Claim 13 wherein the combination of the electrically connected ground plane and heat spreader operate in combination as a electromagnetic shield to reduce the amount of electrical noise produced by the package.

25       15.       A computer incorporating the system of Claim 10.

16.       A semiconductor integrated circuit (IC) package comprising:  
                  a substrate including at least one electrical ground plane and having a plurality solder balls formed on a surface thereof, said solder balls including a set

of thermal solder balls electrically connected with a ground plane and positioned near the perimeter of the package;

an integrated circuit die mounted to the substrate such that the die is electrically connected with some of the solder balls;

5 a heat spreader mounted on the package with conductive mounting pegs that are electrically connected with the ground plane and such that the heat spreader is in thermal communication with the die and in thermal communication with the set of thermal solder balls thereby enabling a portion of the heat generated by the die to be dissipated from the die through the heat spreader into

10 the set of thermal solder balls; and

the combination of the electrically connected heat spreader, ground plane, and conductive mounting pegs operating together as a electromagnetic shield that reduces the amount of electrical noise of the package.

15 17. An electronic device incorporating the IC package of Claim 16.

18. An electronic device incorporating the IC package of Claim 16 wherein the electronic device comprises a computer device.

20